Collaborative Water Monitoring Program to Support Modeling and Restoration of Barnegat Bay, NJ

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Water Monitoring and Standards
NJDEP

9th National Water Monitoring Conference
Cincinnati, OH

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Outline

- Presentation at 2012 NWM Conference
- Background
- Monitoring Objectives & Components
- Selected Monitoring Results
- Data use
Barnegat Bay Stressors and Ecological Concerns

Ecological concerns include:
- Degrading water quality
- Loss of SAV
- Occurrences of macroalgae & brown tide
- Declining hard clams
- Increasing stinging nettle populations

Stressors include:
- Rapid population increase, LU/LC Changes, intensive boating uses, nuclear facility cooling water discharge, nutrient & other pollutant loadings
Governor’s Comprehensive Action Plan for Barnegat Bay December 9, 2010

(to address ecological health of bay)

1. Close Oyster Creek Nuclear Facility Early
2. Fund Stormwater Mitigation Projects
3. Reduce Nutrient Pollution from Fertilizers
4. Require Post-Construction Soil Restoration
5. Acquire Land in the Watershed
6. Est. Special Area Management Plan
7. Adopt More Rigorous Water Quality Standards

**Monitoring Consortium & Model Development**

8. Educate the Public
9. Fill Research Gaps – 10 projects developed
10. Reduce Water Craft Impacts
Objectives of Barnegat Bay Water Monitoring Program

- Determine the locations and extent of water quality impairments

- Calibrate and validate modeling tools
  - Identify numeric criteria or loading targets for nutrients
  - Simulate the effect of potential future conditions
  - Direct water quality restoration and/or TMDL development for the bay
Partners

- MateOs OCUTS
- USGS
- Brick Utilities
- Ocean County Utilities Authority
- State of New Jersey Pinelands Commission
- United States Environmental Protection Agency
- ReClam the Bay Barnegat Bay, NJ
- New Jersey Department of Environmental Protection
- Urban Coast Institute
- Monmouth University
- NJ Forest Resource Education Center
- Division of Parks and Forestry
- Barnegat Bay Partnership

NJDEP Water Monitoring and Standards
Monitoring Program

- **Flow Monitoring – DEP & USGS**
  - Tributaries: Manual measurement and gaging stations
  - Bay: gaging stations and tide gage

- **Water Quality Sampling – DEP & Many Partners**
  - Discrete Water Quality Samples – tributary and bay stations
  - Continuous Monitoring – fixed and buoy
  - Intensive sample events
Flow Monitoring

- **Gaging stations**
  - 7 along the tributaries
  - 3 on bay inlets
  - 3 on the bay

- **Manual measurements**
  - At the tributary stations where there is no gaging stations
Water Quality Monitoring Stations

- **Tributaries Stations (BT)**
  - Above the head of tide
  - 13 (12) major tributaries for grab samples
  - One fixed continuous monitoring station

- **In-bay station (BB)**
  - 15 grab sample stations
  - 1 fixed continuous WQ station
  - 4 buoys
Discrete Sample Collection

- **Phase 1** (6/11-3/12)
  - 13 Trib stations & 14 Bay stations
  - ~ biweekly sampling frequency
  - A total of 18 sampling events completed

- **Phase 2** (4/12-12/12)
  - 12 Trib stations & 15 Bay stations
  - March to Sept.: 4 times / month; Oct- Dec.: 2 times / month
  - A total of 27 sampling events
  - Surface and bottom samples

- **Phase 3** (01/13 – 06/13)
  - 7 Trib stations & 15 bay stations
  - Jan and Feb 2 times/month, March- June 4 times/month
  - Less bottom samples
  - A total of 21 sampling events
Parameters

• Field Parameters
  – Temp, DO, DO Sat, pH, SC, Turbidity

• Laboratory Parameters
  – TSS, BOD5, CBOD5, CBOD20, Dissolved and Total Nutrients, Alkalinity, Silica, TOC, DOC, Chlorophyll a

• Bay Only
  – Surface and bottom samples, Salinity, Secchi Depth
Intensive Sampling Summer 2012

- Two 4-day events
  - July 23rd-26th
  - August 13th-16th

- Bay
  - 6 grab samples/day

- Tributaries
  - 2 grab/day on day 1&4
  - Sondes deployed for duration of both events
    - DO, DO Saturation, pH, Temp, SC
Intensive sample in June 2013

- **3-days events**
  - June 10, 11 and 12

- **Bay**
  - 5 grab samples/day

- **Tributaries**
  - 2 grab/day on day 1&4
  - Sondes deployed for duration of both events
    - DO, DO Saturation, pH, Temp, SC
Continuous Data

- **Two fixed stations**
  - Salinity, Temp, DO, DO%, SC, pH, Turbidity
  - Nitrate at Toms River
  - Chl a at Mantoloking
  - NWIS

- **4 buoys**
  - Salinity, Temp, DO, DO%, SC, pH, Chl a, Turbidity
  - BB04a, BB07a, BB10, BB14
  - Interactive Map
Avg. Nitrogen Conc., mg/L

Dissolved
Total

Legend
TN, mg/L

- 0.15 - 0.40
- 0.41 - 0.60
- 0.61 - 0.80
- 0.81 - 1.00
- 1.01 - 1.20
Avg. Nitrogen Load, kg/d

- **BT01**
- **BT02**
- **BT03**
- **BT04**
- **BT05**
- **BT06**
- **BT07**
- **BT08**
- **BT09**
- **BT10**
- **BT11**
- **BT12**

**Legend**
- TN Load, Kg/day
  - 5 - 50
  - 51 - 90
  - 91 - 120
  - 121 - 150
  - 151 - 420
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<tr>
<th>Station</th>
<th>Avg Salinity, ppth</th>
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Legend:
- **Blue**: 14.7 - 18.0
- **Green**: 18.1 - 22.0
- **Yellow**: 22.1 - 25.0
- **Red**: 25.1 - 28.0
- **Orange**: 28.1 - 31.0
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<thead>
<tr>
<th>Station Code</th>
<th>Ammonia</th>
<th>Nitrite+Nitrate</th>
<th>Dissolved Nitrogen</th>
<th>Total Nitrogen</th>
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Legend:
- Ammonia
- Nitrite+Nitrate
- Dissolved Nitrogen
- Total Nitrogen

Map showing stations BB00 to BB14 with corresponding nitrate concentrations.
<table>
<thead>
<tr>
<th>Station Code</th>
<th>Ortho P</th>
<th>Dissolved P</th>
<th>Total P</th>
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Legend:
- **TP**
  - $< 0.02$
  - $0.02 - 0.03$
  - $0.03 - 0.04$
  - $0.04 - 0.06$
  - $0.05 - 0.06$

NJDEP Water Monitoring and Standards
Data Use

- Adjust the sampling
- Barnegat Bay-specific assessment
- Populate, calibrate and validate the model
- Set up the water quality targets through the linkage with the health of the ecological community.
Governor’s Comprehensive Action Plan for Barnegat Bay

- Plan 9: Produce More Comprehensive Research
  - Lead by Office of Science of NJDEP
    - Contact Thomas Belton (Thomas.belton@dep.state.nj.us)
  - Support water quality improvement (nutrient criteria)
  - Establish the baseline conditions of the bay
  - Fill in critical data gaps
  - Advance habitat restoration on the bay
# BARNEGAT BAY COMPREHENSIVE RESEARCH - OBJECTIVES

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<td>Benthic Invertebrate Community Monitoring and Indicator Development for Barnegat Bay.</td>
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<td>Assessment of Hard Clam Populations in Barnegat Bay</td>
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<td>Assessment of Fishes and Crabs Responses to Human Alteration of Barnegat Bay.</td>
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<td>Assessment of the Distribution and Abundance of Stinging Sea Nettles (Jellyfishes) in Barnegat Bay</td>
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<td>Tidal Freshwater and Salt Marsh Wetland Studies of Changing Ecological Function and Adaptation Strategies</td>
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<td>Ecological Evaluation of Sedge Island Marine Conservation Area in Barnegat Bay</td>
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QUESTIONS?